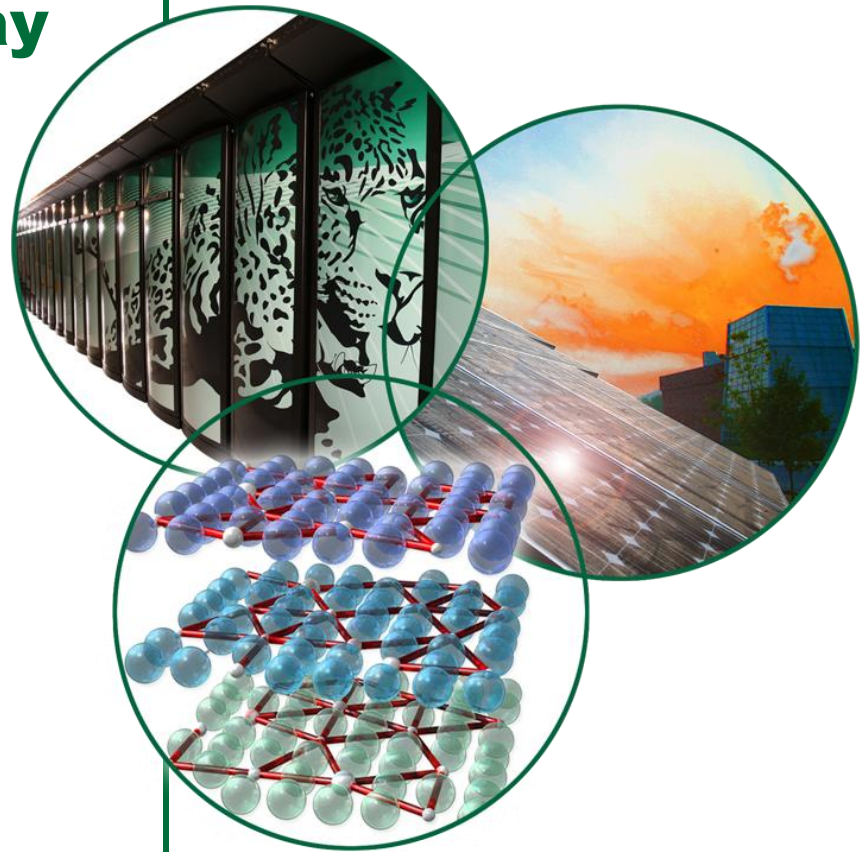


Wind Energy Resources and Outreach: The Wind ENergy Data and Information (WENDI) Gateway (windenergy.ornl.gov)

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WENDI Gateway development is funded by the Wind & Water Power Program of DOE's Energy Efficiency & Renewable Energy Office.



Presentation Outline

- Why the WENDI Gateway?
- Wind energy stakeholders
- ORNL groups developing the Gateway
- What is the WENDI Gateway?
- WENDI Gateway Capabilities
- Outreach
- Summary

Why the WENDI Gateway?

- No shortage of wind energy web sites and resources
- This fact can sometimes make finding the information you want more difficult and time consuming
- Framing and answering wind energy-related questions requires efficient discovery and access to information
- Project goal: a convenient, powerful, *virtual* gateway to data and information – *a smart place to start*
- In addition, developing select, *value-added* products is also a key – examples to follow



Wind energy stakeholders –

Consider their information needs in developing the Gateway



Developers and construction companies



Utilities



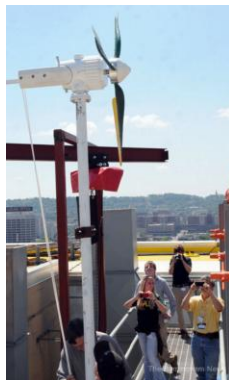
Wildlife researchers



Students and educators



Landowners
and
Civic groups



Consumers



Policy makers



WENDI Gateway development seeks to keep them all in mind.

ORNL groups contributing to the development of the Gateway

Environmental Data Science & Systems (EDSS)

- Includes several data centers providing information and analysis support to DOE and NASA global change research programs involved in:
 - Global and regional climate change
 - Land cover change
 - Satellite-derived land, ocean, and atmosphere datasets
 - Carbon cycle studies (CO₂ emissions, CO₂ sequestration, carbon tracking, ocean carbon chemistry)
 - Biogeochemistry of terrestrial ecosystems



*

ORNL groups contributing to the development of the Gateway

Power and Energy Systems Technologies Program



- Broad spectrum of capabilities and experience working with electric utilities, developers, and construction companies.
- Provides expertise and guidance for the development of the WENDI Gateway in the areas of:
 - Power Industry standards
 - Protection and relaying
 - Interconnection rules and standards
 - Integration of electricity generated from renewable sources
 - Transmission
 - Wind plant design

What is the WENDI Gateway?

- A website that's a smart place to start for discovering and accessing wind energy data and information
- Takes a standards-based, virtual data repository approach to provide a single gateway to data and information contained in disparate information systems
- Leverages emergent and existing data, metadata, data delivery, and data visualization standards to enable more efficient research and analysis

WENDI Gateway Capabilities (windenergy.ornl.gov)

The screenshot shows the WENDI Gateway website. At the top is a banner with the WENDI logo and a background image of wind turbines. Below the banner is a navigation bar with links: Home, Wind Search, Wind GIS, About, FAQ, Contact Us, and What's New. The main content area is divided into two columns. The left column has a 'Our Services' section with links to 'Wind Search' (circled in orange), 'Search Wind Energy Metadata Clearinghouse', and 'Wind GIS' (circled in orange), which includes a 'Launch Wind Energy WebGIS Application' link. Below this is a 'What's New' section with two bullet points: 'New content in WENDI Gateway: state requirements on...' and 'Utility-scale wind turbine manufacturers available from...'. The right column has a 'Login/Register' link, a 'Welcome to the Wind Energy Data and Information (WENDI) Gateway' heading, a paragraph describing the gateway's purpose and stakeholders, another paragraph about data integration, and a 'Follow us on' section with Facebook and Twitter icons. At the bottom right are the Oak Ridge National Laboratory and U.S. Department of Energy logos. The footer contains a row of links: Department of Energy (DOE), DOE Energy Efficiency & Renewable Energy, DOE Wind & Hydropower Technologies Program, ORNL Environmental Data Science & Systems, Contact Us, and Security Notice.

WENDI
Wind Energy Data & Information Gateway

Home Wind Search Wind GIS About FAQ Contact Us What's New

Our Services

Wind Search
Search Wind Energy
Metadata
Clearinghouse

Wind GIS
Launch Wind Energy
WebGIS Application

What's New

- o New content in WENDI Gateway: state requirements on...
- o Utility-scale wind turbine manufacturers available from...

Login/Register

Welcome to the Wind Energy Data and Information (WENDI) Gateway

The WENDI Gateway is an integrated system for the archival, discovery, access, integration, and delivery of wind energy-related data and information. This site has been established to support the **U.S. Department of Energy's Wind & Hydropower Technologies Program** and is intended to serve the information needs of a broad range of stakeholders in our nation's efforts to increase wind energy's contribution to U.S. electricity demand. Wind energy stakeholders and data users may include - but are not limited to - wind plant developers and constructors, electric utility companies, wind energy modelers/forecasters, environmental scientists, ecologists, policy makers, local and civic organizations, academia, educators, and the general public.

Since it is highly likely that any given wind energy-related question or issue requires data integrated from multiple sources, this site has been designed as a virtual data repository, providing a gateway to information from a variety of data centers and web sites, including those of federal and state governments, academia, private industry, and wind energy-related trade associations. The tools and interfaces on this site have been designed to facilitate the discovery, visualization, subsetting, and downloading of this information.

Follow us on
Facebook or Twitter

OAK RIDGE
National Laboratory

U.S. DEPARTMENT OF ENERGY

Department of Energy (DOE) DOE Energy Efficiency & Renewable Energy DOE Wind & Hydropower Technologies Program ORNL Environmental Data Science & Systems Contact Us | Security Notice

Wind Energy Metadata Clearinghouse

- Distributed metadata management, data discovery and access system
- Based on a combination of open source and ORNL-developed software (Mercury)
- Provides free-text, fielded, spatial, and temporal search capabilities
- Architecture supports various metadata standards and specifications:
 - Supports: FGDC, ISO19115, Dublin-Core, Darwin-Core, GCMD, EML, Z39.50, OAI-PMH.
 - Supports: controlled web crawling for WIND energy-related websites
 - Can be easily extended to support other standards

Wind Energy Metadata Clearinghouse Searching

Simple,
Google-like
option

Simple Search Advanced Search

Fielded Search

FullText **interconnection standards**

Help | clear

Date Search

☒ Data Collection Date ☐ Publication Date ☐ Either

during

mm/dd/yyyy thru mm/dd/yyyy

Help | clear

Geographic Search

List Areas in:

USA ☒ WORLD ☐

Select from list

Search Area:

overlaps ☒ encloses ☐

North

West East

South

Place: view on map

Help | clear

Format

All

Maps and Data

Publications

Tools and Software

Data sources

All

National Biological Information Infrastructure Database

Yellowstone-to-Yukon Data Library

ORNL-compiled wind energy data collection

Pacific Northwest National Laboratory Ecology Group

Western EcoSystems Technology, Inc (Web resource)

American Wind Energy Association (Web resource)

U.S. Environmental Protection Agency (Web resource)

DOE Energy Efficiency and Renewable Energy Program (Web resource)

DOE Energy Efficiency and Renewable Energy – Tribal Energy Program (W

Query being built:

Entire Document : interconnection standards and fullText = interconnection standards and Format: All and from sources: All

Not Editable

CLEAR QUERY HELP

SEARCH

Filtering
Options

Use state
drop-down;
zoom
in/out; draw
box to
zoom and
select; type
in place
name.

Wind Energy Metadata Clearinghouse Searching

Metadata Summary

Share / Save RSS Feed Help

Your search found: 66 documents.
You searched for: text : interconnection text : standards

Filter by Decade
[Unknown \(65\)](#)
[2000 to 2009 \(1\)](#)

Filter by keywords
[wind \(59\)](#)
[interconnection \(55\)](#)
[net metering \(53\)](#)
[renewable energy \(53\)](#)
[alternative pow \(52\)](#)
[customer owned \(52\)](#)
[distributed gen \(52\)](#)
[non-utility own \(52\)](#)

Filter by **keyword**; e.g.,
state of Tennessee

Viewing Documents 1 - 10 out of 66

Prev 1 2 3 4 5 6 7 Next

Back Modify search

Sort By: Index Rank Pubdate Source

Filter by Data Providers
[ORNL-compiled wind energy data collection \(62\)](#)
[American Wind Energy Association \(2\)](#)
[DOE Energy Efficiency and Renewable Energy Program \(2\)](#)

INTERCONNECTION STANDARDS
01/01/0001 - 01/01/2010
Data provider: ORNL-COMPILED WIND ENERGY DATA COLLECTION

This GIS layer illustrates which states have statewide standards for interconnection of distributed generation and which do not. The majority of states have some version of statewide interconnection standards for distributed generation in place. However, these standards vary significantly among and even within states based on factors such as generating capacity and means of generation. Furthermore, statewide standards may apply only to investor-owned utilities (IOUs), not to municipal and electric cooperatives, and/or only to net metered systems....

★★★★★★★★★★

[View full metadata](#)

INTERCONNECTION STANDARDS
01/01/0001 - 01/01/2010
Data provider: ORNL-COMPILED WIND ENERGY DATA COLLECTION

Standard interconnection rules establish clear and uniform processes and technical requirements that apply to utilities within a state. These rules reduce uncertainty and prevent time delays that clean distributed generation (DG) systems can encounter when obtaining approval for electric grid connection. States that modified interconnection rules focusing only on net-metered systems have found these changes were insufficient to encourage clean DG. This is largely due to the small capacity limits on net-metered systems, which limits larger DG systems from accessing the grid for backup power...

★★★★★★★★★★

[View full metadata](#)

OHIO INTERCONNECTION STANDARDS
01/01/0001 - 01/01/2010
Data provider: ORNL-COMPILED WIND ENERGY DATA COLLECTION

Wind Energy Metadata Clearinghouse Searching

Metadata Summary

Share / Save RSS Feed Help

Your search found: 2 documents.
You searched for: text : interconnection text : standards AND Keywords:tennessee
Filters: Keywords : tennessee ([remove](#))

Filter by Decade
[Unknown \(2\)](#)

Viewing Documents 1 - 2 out of 2

[Prev](#) [Next](#)

[Back](#) [Modify search](#)

Sort By: **Index Rank** Pubdate Source

Filter by Data Providers
[ORNL-compiled wind energy data collection \(2\)](#)

TENNESSEE INTERCONNECTION STANDARDS 01/01/0001 - 01/01/2010
Data provider: ORNL-COMPILED WIND ENERGY DATA COLLECTION
Tennessee does not have statewide interconnection standards. In June 2007 the Tennessee Valley Authority's (TVA) staff recommended adopting interconnection and net-metering standards outlined in the Energy Policy Act of 2005 (EPAAct 2005). In August 2007, the TVA adopted a modified version of the Public Utilities Regulatory Policies Act (PURPA) 2005: TVA shall make available, upon request, interconnection service, for generators with output of 20 MW or less, to any electric consumer that it serves. As part of its decision, TVA is allowing the distribution utilities that operate in its territory the flexibility to create their own interconnection procedures that are similar to TVA's (source: <http://www.eea-inc.com/rrdb/DGRegProject/States/Newsite/TNrevised.html#interconnection>)...
★★★★★★★★★
[View full metadata](#)

DSIRE SEARCH TOOL FOR RENEWABLES AND EFFICIENCY INCENTIVES 04/01/0001 - 01/01/2010
Data provider: ORNL-COMPILED WIND ENERGY DATA COLLECTION
Allows the user to create a custom summary of incentives related to renewable energy development and energy efficiency....
★★★★★★★☆☆
[View full metadata](#)

Wind Energy Metadata Clearinghouse Searching

Metadata Report	
You searched for: text : interconnection text : standards and keywords:tennessee	
Email Bookmark	
Back Modify search	
Title:	Tennessee Interconnection Standards
Source:	ORNL Compiled Interconnection Data Collection
URL or Email:	wibkingml@ornl.gov
Resource Type:	Collection
Status:	Subject to Updates
Access Restrictions:	Public
Data Center Contact:	Wibking, Melynda - wibkingml@ornl.gov Phone:
Download Data Sets:	
Abstract:	Tennessee does not have statewide interconnection standards. In June 2007 the Tennessee Valley Authority's (TVA) staff recommended adopting interconnection and net-metering standards outlined in the Energy Policy Act of 2005 (EPAAct 2005). In August 2007, the TVA adopted a modified version of the Public Utilities Regulatory Policies Act (PURPA) 2005: TVA shall make available, upon request, interconnection service, for generators with output of 20 MW or less, to any electric consumer that it serves. As part of its decision, TVA is allowing the distribution utilities that operate in its territory the flexibility to create their own interconnection procedures that are similar to TVA's (source: http://www.eea-inc.com/rrdb/DGRegProject/States/Newsite/TNrevised.html#interconnection).
Related Resources:	Tennessee Valley Authority -- Standard Large Generator Interconnection Procedures (LGIP) (Applicable to Generating Facilities that exceed 20 MWs) -- Green Power Switch Generation Partners -- Generation Partners Expanded Pilot Participation Agreement -- Wind Technical Fact Sheet -- Participating Power Distributors Knoxville Utilities Board -- Generation Partners -- Distributed Generation Interconnection Procedures Under the TVA/KUB Generation Partners Program -- Interconnection Agreement -- Generation Partners - Standard Overhead Connection -- Generation Partners - Standard Overhead Primary -- Generation Partners - Standard Underground Connection -- Generation Partners - Standard Underground Primary Memphis Light, Gas, and Water

Wind Energy Metadata Clearinghouse Searching

Combining data and information sources to get an estimate of wind turbine performance:

Home
Wind Energy Metadata Clearinghouse
Wind Energy Search

Simple Search Advanced Search

The Wind Energy metadata clearinghouse is a powerful resource for the users, allowing them to share and access information about important research in wind energy.

Bureau of Reclamation

Hint: boolean operators, wildcards and phrases
ex: precipitation or (rain* and "moisture")

Query being built:

Not Editable

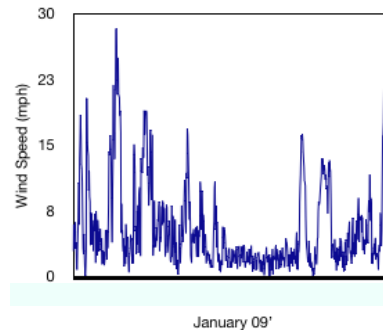
CLEAR QUERY HELP

Wind Energy metadata Clearinghouse
information

Bureau of Reclamation

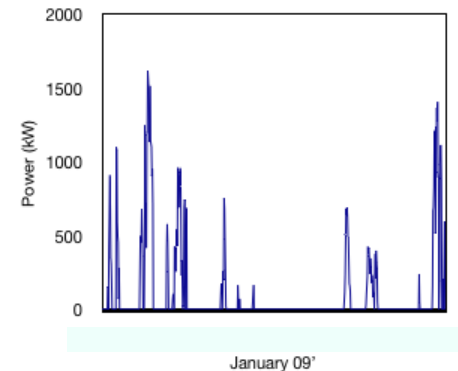
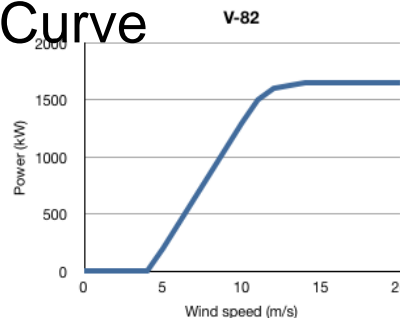
Hint: boolean operators, wildcards and phrases
ex: precipitation or (rain* and "moisture")

Query being built:



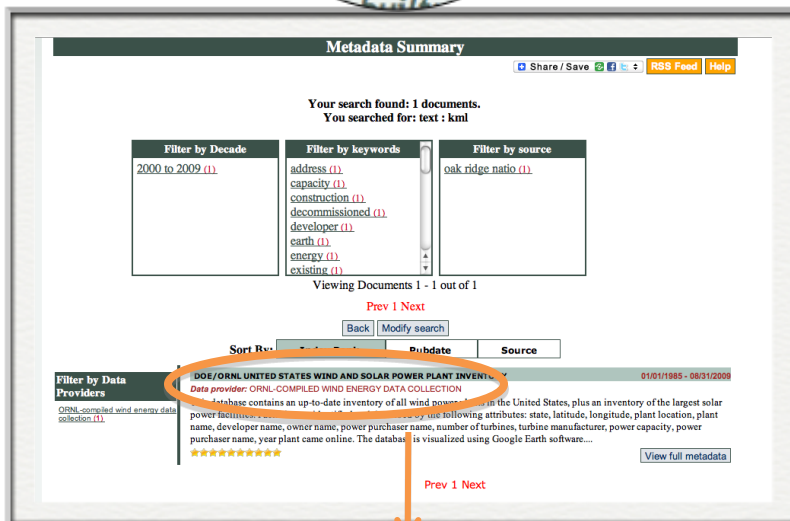
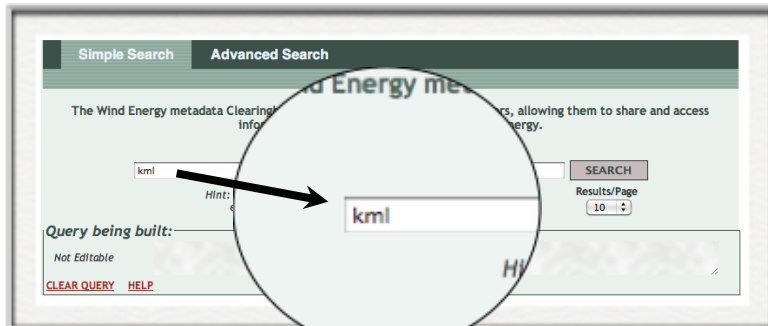
Get Wind Speed

Get Wind Turbine
Performance
Curve

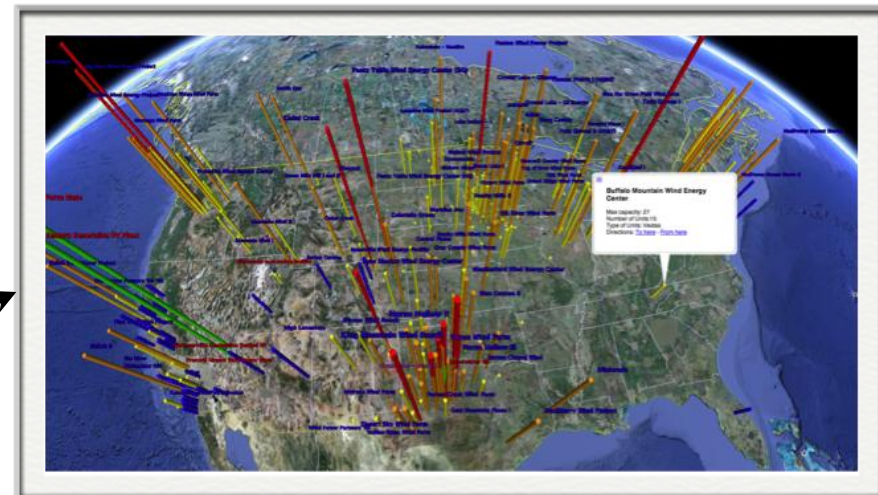


Utilization
Factor: 28%

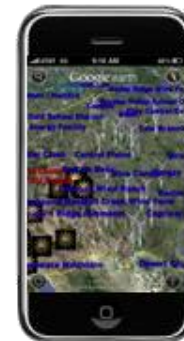
Wind Energy Metadata Clearinghouse - Google Earth Application from ORNL



United States Wind and Solar Plant Inventory



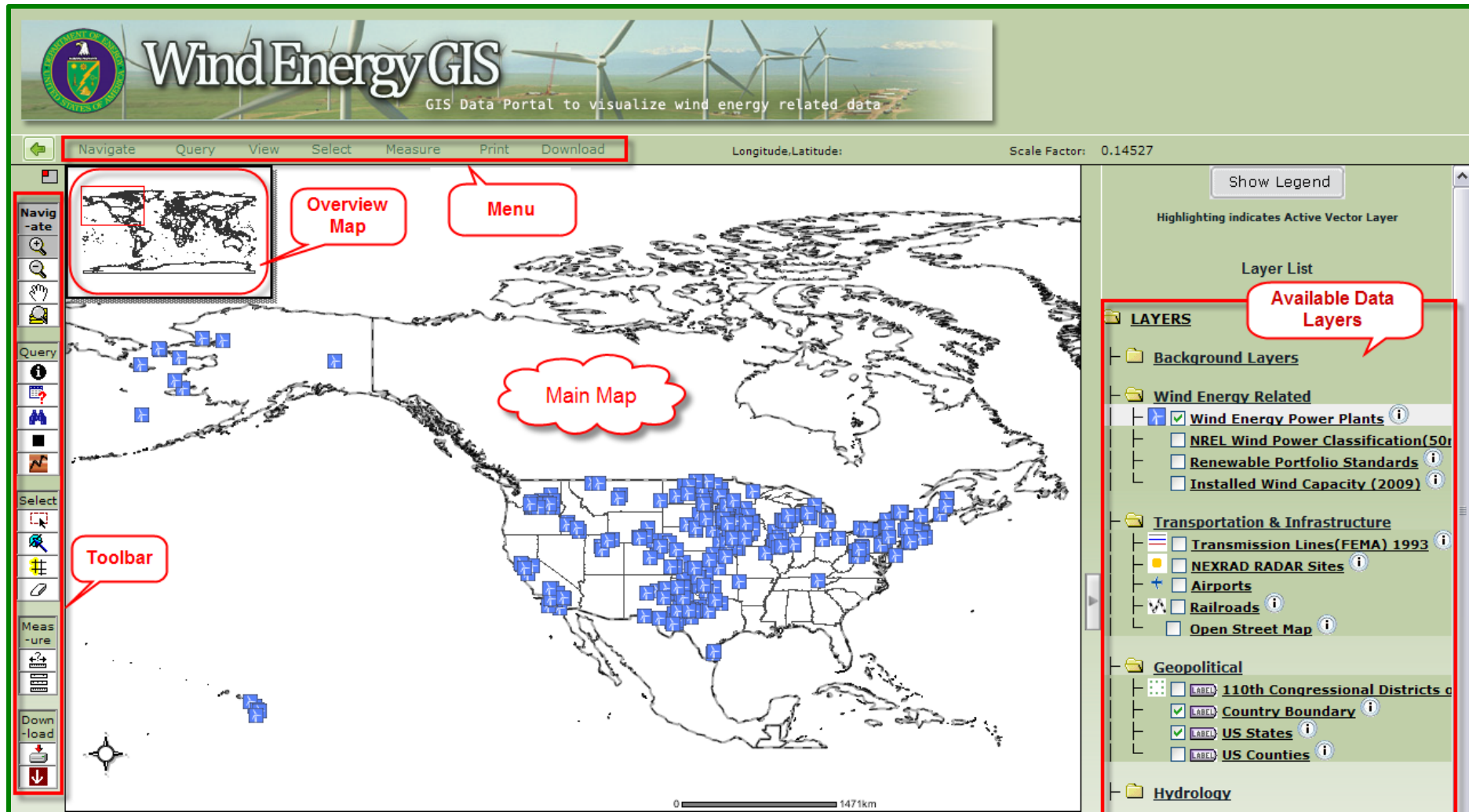
Download and Run
in Google Earth



*

WENDI Gateway Wind Energy GIS (WindGIS)

Depiction of Start page showing sample data layers and navigation features



WENDI Gateway WindGIS

- WindGIS supports Open Geospatial Consortium (OGC) Web Map Service (WMS).
- Using OGC-WMS, any client that supports OGC-WMS can have access to visualizations of the data sets included in WindGIS.

“Homegrown” layers:
Wind Plants
RPS
Interconnection standards
Turbine manufacturers
Net wind c

Infrastructure:
Transmission lines
Major airports
Railroads
NEXRAD

- ers:
- et Map
- L Landsat
- Research Maps



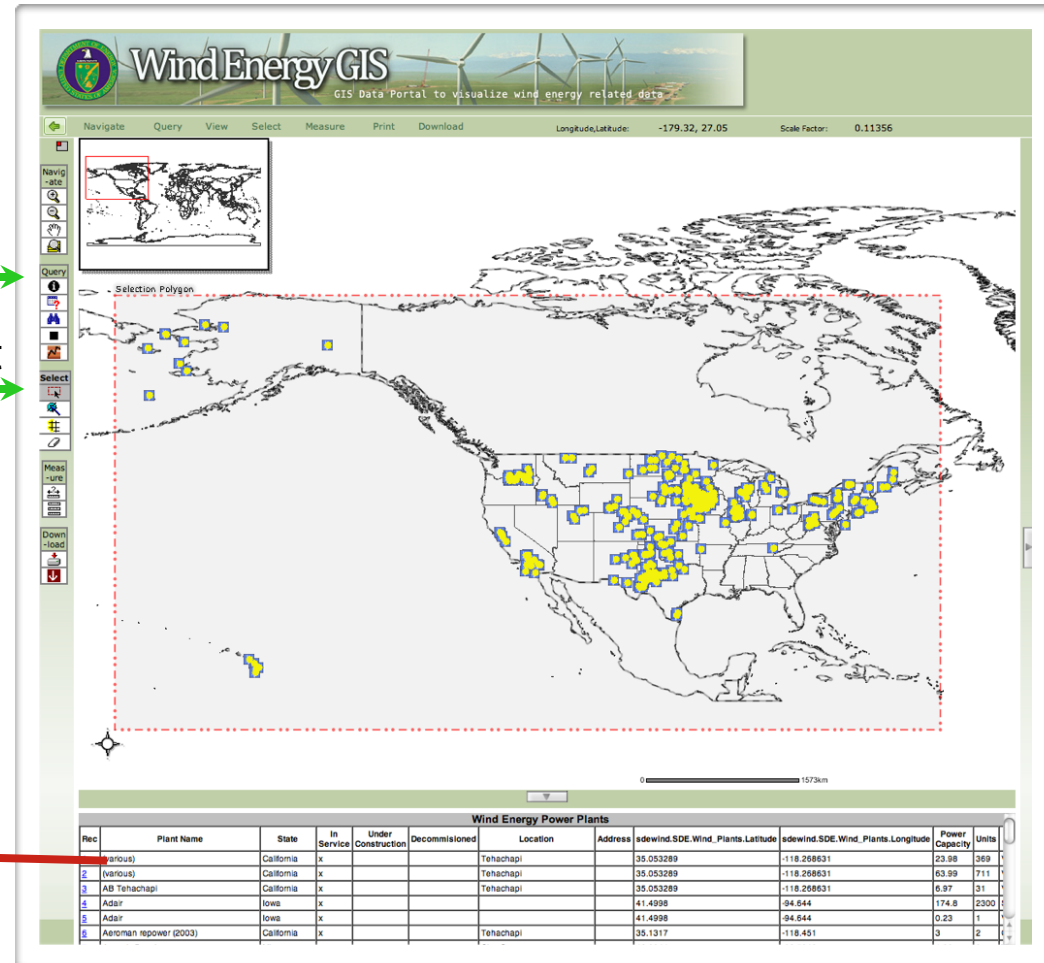
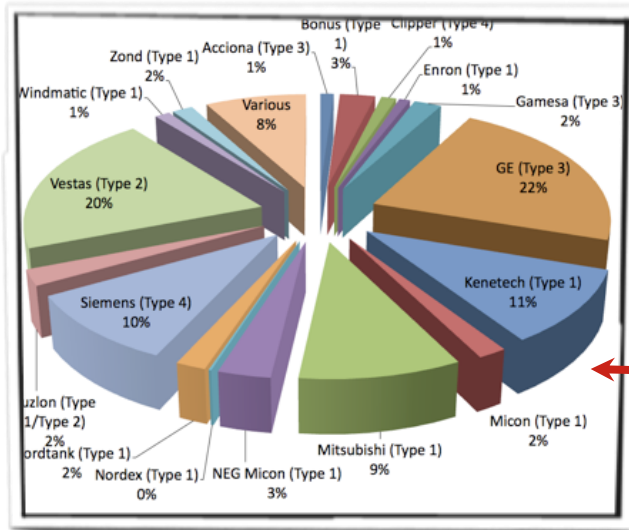
Using WindGIS to explore installed wind turbine types

☼ GIS querying enables analysis of large amounts of data.

Query

Select

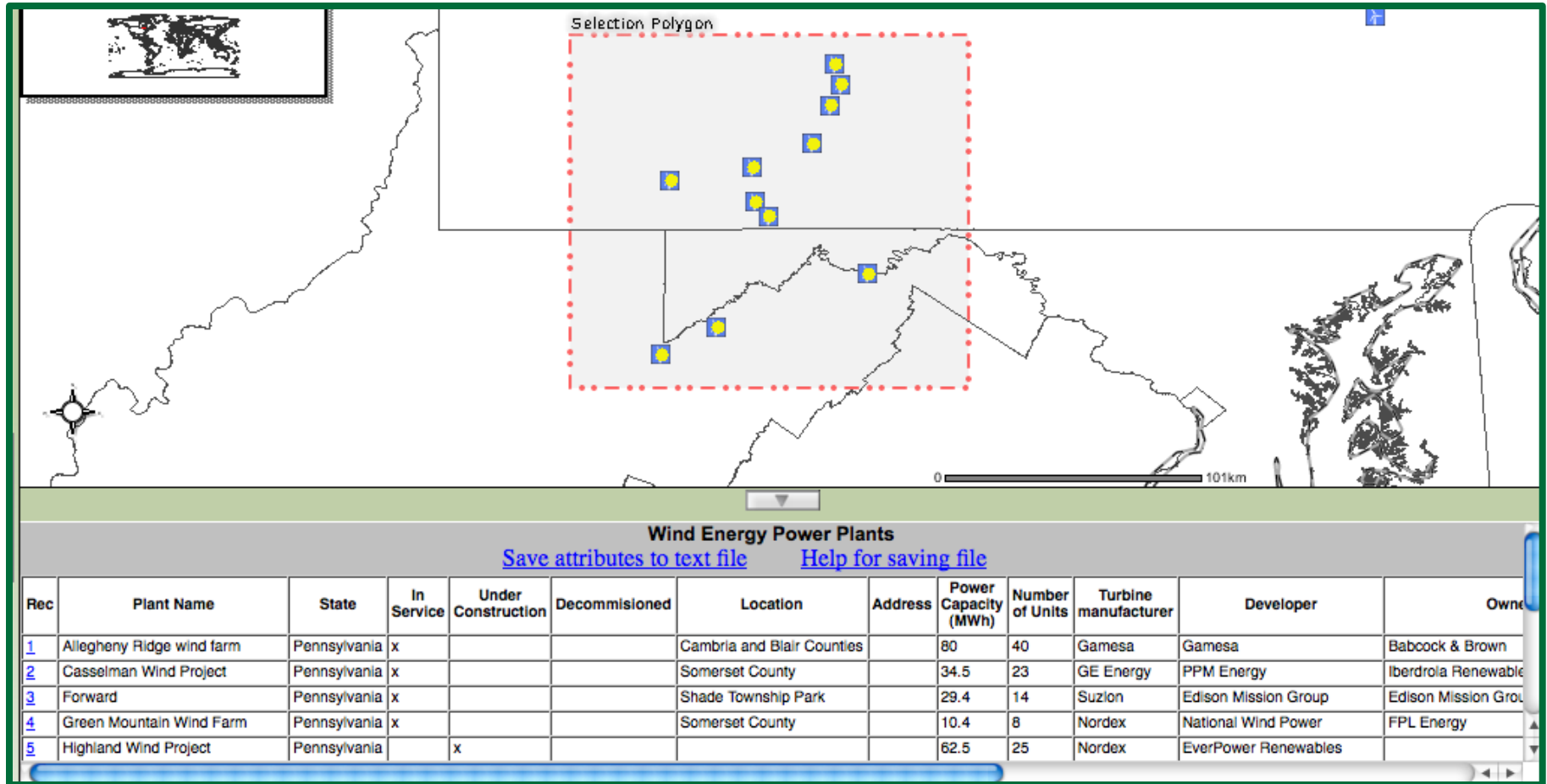
Types



*

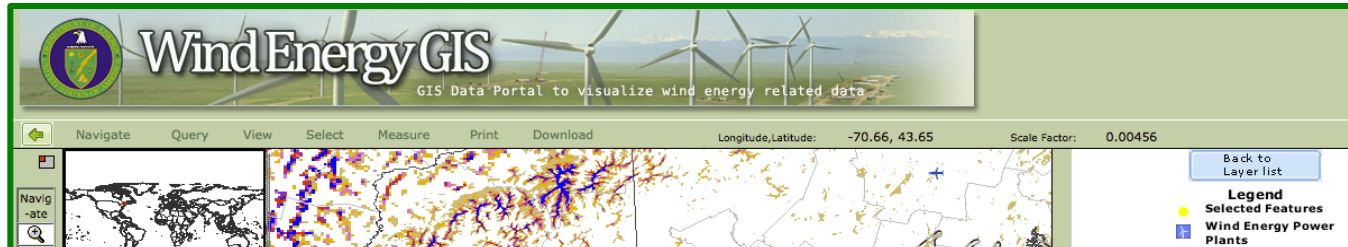
WENDI Gateway WindGIS

Key Layer: U.S. Wind Plants



WENDI Gateway WindGIS

View showing NREL 50-m wind resource, wind plants, and airports



Note: The latest NREL 80-m wind resource maps released earlier in 2010 are not available as shapefiles for GIS. In fact, for some states, the earlier 50-m maps are not available as shapefiles. This is unfortunate given the power that GIS can bring to these very high-res spatial data. Of course, the maps are available as stand-alone graphics files (discoverable through the Metadata Clearinghouse).

Rec	State	In Service	Under Construction	Decommissioned	Plant Name	Location	Address	Turbine manufacturer	Developer
1	Massachusetts	x			Forbes Park	Chelsea		Boreal Renewable Energy	Fort
2	Massachusetts	x			Hull	Hull		Vestas	Hull Municipal Light Department
3	Massachusetts	x			Hull II	Hull		Vestas	Hull Municipal Light Department
4	Massachusetts	x			Hyannis Country Garden	Hyannis		DES	Hyan
5	Massachusetts	x			IBEW Local 103	Dorchester		Fuhr?nder	IBEW Local 103
6	Massachusetts	x			Jiminy Peak Ski Resort	Hancock		GE Energy	Sustainable Energy Developments
7	Massachusetts	x			Massachusetts Maritime Academy	Buzzards Bay- Cape Cod		Vestas	Massachusetts Maritime Academy

WENDI Gateway WindGIS

View depicts EPA-tracked renewable energy sites, railroads, and transmission lines near *Steel Winds* Wind Farm (8 turbines, 20 MW), developed on the former Bethlehem Steel site in Lackawanna, NY.



WENDI Gateway Outreach

- Presentations to utility companies and other interests
 - Southern Company, so far, and meetings like this one
- Website Registration enables users to contribute data, metadata, and information
 - via metadata input form (in beta now)
 - WENDI Gateway science team reviews the submission
 - upon acceptance, made available through metadata clearinghouse
 - registered users can add a comment to any specific information found in the WENDI gateway, or start a controlled discussion thread for a specific wind energy-related topic
- Use of main social networking sites
 - Keep users informed about new GIS layers and value-added products
 - monitor needs and interests of wind energy stakeholders

Summary

- The WENDI Gateway – windenergy.ornl.gov
- Archival, discovery, access, integration, and delivery of wind energy-related data and information; supports DOE's Wind & Water Power Program.
- Good place to start for wind energy data and information
- Standards-based, virtual data repository that leverages emergent and existing data, metadata, data delivery, and data visualization standards to enable more efficient research and analysis
- Unique resource for spatial visualization and analysis of wind energy-related data

Summary

- Metadata holdings continually increasing; GIS layers continually being added
- Internet and old-fashioned, in-person outreach ramping up; asking for suggestions and feedback from stakeholders, site users, informatics experts, and potential data contributors.

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Thank you